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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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OWEN J GAMON
IBM CORPORATION DEPT 917
3605 HIGHWAY 52 NORTH
ROCHESTER, MN 559017829

EXAMINER

NGUYEN BA, HOANG VU A

ART UNIT	PAPER NUMBER
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2122

DATE MAILED: 10/02/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/286,862

Applicant(s)
Prosser et al.

Examiner
Hoang-Vu Antony Nguyen-Ba

Art Unit
2122



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Apr 23, 2002
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 9-12, and 17-20 is/are rejected.
- 7) ☒ Claim(s) 5-8, 13-16, and 21-24 is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on Apr 23, 2002 is: a) ☒ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 6) ☐ Other:

Art Unit: 2122

DETAILED ACTION

Notice to Applicant(s)

1. This action is responsive to the amendment filed April 23, 2002.
2. Per Applicants' request, claims 1-3, 9-11, 17-19 have been amended.
3. In view of Applicants' corrections to the drawings, the objection to these drawings are hereby withdrawn.
4. In view of Applicants' amendment to claim 9 to correct a lack of antecedent basis for the term "computer procedure," the rejection under 35 U.S.C. § 112, second paragraph, of this claim is hereby withdrawn.
5. In view of Applicants' argument that the Patent Office and the Federal Circuit have long agreed "that computer programs embodied in a tangible medium, such as floppy diskettes, are patentable subject matter under 35 U.S.C. § 101...", the rejection of claim 17-24 is hereby withdrawn.
6. Claims 1-24 are pending.

Response to Arguments

7. Applicant's arguments filed April 23, 2002 have been fully considered but they are not persuasive. In view of Applicants' insignificant amendments to claims 1-4, 9-

Art Unit: 2122

12 and 17-20, the rejection of these claims under 35 U.S.C. § 103 (a) made in the previous Office action is still proper and maintained. Following is the examiner's response to Applicants' arguments.

8. With respect to claims 1, 9 and 17, 2-4, 10-12, and 18-20, Applicants have essentially argued that:

(i) neither reference, i.e., Gillies nor Carini, discloses "making at least one inlining decision using the site register-pressure data during a second compilation."

In response to this argument, it is noted that these claims are rejected as being obvious using a combination of Gillies and Carini. Applicants cannot show non-obviousness by attacking the references individually where, in this instance, the rejection is based on a combination of references. In this instance, as discussed in the Office action: a) Gillies does disclose making at least one decision using the collected information (e.g., register pressure information) to compute an interprocedural solution to enhance the optimization of an application (3:56-60); b) Gillies does not specifically disclose that the decision is to apply the inlining process; c) however, Gillies does disclose that information as to suitability for inlining is also collected (4:4-33); d) Carini discloses a method for automatic inlining; therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to

Art Unit: 2122

use Carini's automatic inlining to compute an interprocedural solution for the application because this interprocedural solution enhances the optimization of the application (3:57-60).

(ii) even if the combination disclosed the claimed invention, the references teach away from the suggested combination. In response to this argument, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. In this case, as discussed above, Gillies does disclose that information as to suitability for inlining is also collected (4:4-33) so that automatic inlining could be implemented if necessary to enhance the optimization of an application. As is known in the art, automatic inlining can be used with or without relying on profiling information. It is noted that only the automatic inlining aspect of Carini is used for the combination of Gillies and Carini.

In view of the foregoing discussion, the examiner maintains that the rejection of claims 1-4, 9-12 and 17-20 under 35 U.S.C. § 103 (a) as unpatentable over Gillies and Carini is proper.

Art Unit: 2122

It is also noted that features of claims 5, 13, and 21, which are identified as being not taught or suggested by either Gillies or Carini and if incorporated in claims 1, 9 and 17, would put these claims in condition for allowance.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1-4, 9-12, and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gillies, U.S. Patent No. 5,768,595, in view of Carini, U.S. Patent No. 5,740,443.

Claim 1

Gillies discloses *a method for optimizing a computer program* (see at least Abstract, lines 1-2) *comprising a child procedure and a parent procedure, wherein the parent procedure comprises at least one statement that invokes the child procedure, wherein the method comprises:*

Art Unit: 2122

saving site register-pressure data from the execution (see at least column 4, lines 5-33) *of a first compilation* (see at least column 3, line 54-56); *and*

making at least one decision using the site register-pressure data during a second compilation (see at least column 3, lines 56-60).

Gillies does not specifically disclose *inlining*. Gillies, however, suggests that his information collection can be used for other optimization techniques, i.e., inlining and cloning (column 4, lines 24-27). Further, Carini discloses an automatic inlining method which provides the same function as user directed inlining but is more convenient in practice and requires less user effort and time (see at least column 6, lines 3-17). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use Carini's automatic inlining method in the second pass compilation of Gillies (Gillies, column 3, lines 56-60) because the combination of Gillies and Carini would make Gillies' recompiling of computer programs for enhanced optimization more convenient in practice and requiring less programmer's effort and time (Carini, column 6, lines 10-11).

Art Unit: 2122

Claim 2

Gillies further discloses *saving a register-pressure occurring in each procedure in the computer program* (column 4, lines 6 and 33); *and making the at least one inlining decision using the register-pressure data* (see at least column 3, lines 56-60).

Gillies does not specifically disclose a *maximum* register-pressure. However, information about a maximum register-pressure is deemed to be obvious as part of information collected during the first pass compiling (column 4, line 33) in the teaching of Gillies because this information could be used to prevent code-size explosions caused by over-inlining, as suggested by Gillies at column 6, line 60-66. It is known in the art that it is undesirable to inline a child procedure into a parent procedure if the number of registers used reaches a maximum because to do so would spill the values stored in some of these registers into memory -- i.e., memory spill --, thereby causing more processing time delay, on top of the additional processing time caused by the code size increase of the program due to aggressive inlining -- over-inlining--. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the maximum register-pressure information in

Art Unit: 2122

Gillies to prevent over-inlining which thereby defeats the purpose of recompiling optimization.

Claim 3

Gillies further discloses *a register pressure at each call site in a computer program* (see at least column 4, lines 18, 24-27, and 33). Gillies does not specifically disclose call site *that is a potential inlining candidate*. However, Gillies does disclose information collected that is information usable for inlining (column 4, lines 24-25) for the purpose of optimization. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Gillies to identify call site that is potential candidate for inlining by using the information usable for inlining (see also discussion in the rejection of claim 2) because this would prevent code-size explosion caused by over-inlining which could defeat the purpose of optimization by inlining.

Claim 4

Gillies does not specifically disclose *inlining the child procedure of the computer program into the parent procedure, in place of the statement that invokes the child procedure*.

However, Carini discloses an automatic inlining method which provides the same

Art Unit: 2122

function as user directed inlining (column 6, lines 8-10) for the purpose of performance improvements. It is noted that inlining is a well known compile-time optimization that can substantially improve the execution performance of programs by replacing a procedure -- *parent procedure* -- call with the body of the called procedure -- *child procedure* -- (also see discussion in the rejection of claims 1 and 2). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine Carini with Gillies because the combination would make Gillies' recompiling of computer programs for enhanced optimization more convenient in practice and requiring less programmer's effort and time (Carini, column 6, lines 10-11).

Claim 9

Gillies discloses *a computer system* (see at least Figure 5) *for compiling a computer program* (see at least Figure 5, block 38) that performs the same steps of the method recited claim 1. The same rejection is therefore applied.

Further, Gillies discloses *a machine readable code generator that generates a machine readable representation of the computer procedure from the optimized representation* (see at least Figure 1, block 4).

Art Unit: 2122

Claim 10

Gillies further discloses the same limitation of claim 2. Therefore, the same rejection is applied.

Claim 11

Gillies further discloses the same limitation of claim 3. Therefore, the same rejection is applied.

Claim 12

Gillies further discloses the same limitation of claim 4. Therefore, the same rejection is applied.

Claim 17

Gillies discloses *a program product for optimizing a computer program* (see at least Figure 1, block 38) that performs the same steps recited in claim 1. Therefore, the same rejection is applied.

Gillies further discloses a *signal-bearing media bearing the optimizer* (see at least Figure 5, blocks 36 and 34).

Art Unit: 2122

Claim 18

Gillies further discloses the same limitation of claim 2. Therefore, the same rejection is applied.

Claim 19

Gillies further discloses the same limitation of claim 3. Therefore, the same rejection is applied.

Claim 20

Gillies further discloses the same limitation of claim 4. Therefore, the same rejection is applied.

Allowable Subject Matter

11. Claims 5-8, 13-16, and 21-24 are objected to as being dependent upon a rejected base claim, but would be allowable over the prior art of record once any other

Art Unit: 2122

outstanding rejections are traversed and if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

12. The following claimed features are not shown or suggested by the prior art of record:

determining whether a sum of the maximum register-pressure and the site register-pressure exceeds a number of available registers (claims 5, 13, and 21);

when the determining step is true, refraining from inlining the child procedure into the parent procedure (claims 6, 14, and 22);

when the determining step is false, inlining the child procedure into the parent procedure in place of the statement that invokes the child procedure (claims 7, 15, and 23);

setting the maximum register-pressure of the parent procedure to be a maximum of its existing value or the sum of the maximum register-pressure of the child procedure and the site register-pressure (claims 8, 16, and 24).

Conclusion

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Art Unit: 2122


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

14. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Examiner Antony Nguyen-Ba, whose telephone number is (703) 305-0103. The Examiner can normally be reached on Monday-Thursday from 6:30 AM - 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Morse can be reached at (703) 308-4789.

Art Unit: 2122

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-3900.


GREGORY MORSE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100

Hoang-Vu Antony Nguyen-Ba

September 23, 2002